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CLAIMS:

1. An electrochemical cell for electrochemical reduction of a metal oxide in a solid state includes: a  
5 molten electrolyte, an anode formed from carbon in contact with the electrolyte, a cathode formed at least in part from the metal oxide in contact with the electrolyte, and a membrane that is permeable to oxygen anions and is impermeable to carbon in ionic and non-ionic forms  
10 positioned between the cathode and the anode to thereby prevent migration of carbon from the anode to the cathode, the membrane includes a body and a lining on the surface of the body on the cathode side of the membrane, and the lining is formed from a material that is inert with  
15 respect to dissolved metal in the electrolyte and is impermeable to the dissolved metal.
2. The cell defined in claim 1 wherein, in a situation in which the metal oxide is titania and the  
20 electrolyte is a  $\text{CaCl}_2$ -based electrolyte that includes  $\text{CaO}$  whereby the dissolved metal is calcium metal, the lining is formed from a material that is inert and impermeable with respect to calcium metal.
- 25 3. The cell defined in claim 1 or claim 2 wherein the anode is formed from graphite.
4. The cell defined in any one of the preceding claims wherein the body of the membrane is formed from a  
30 solid electrolyte.
5. The cell defined in claim 4 wherein the solid electrolyte is an oxide.
- 35 6. The cell defined in claim 5 wherein the oxide is yttria stabilised zirconia.

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7. The cell defined in any one of the preceding claims wherein the lining is formed from an oxide.

5 8. The cell defined in claim 7 wherein the lining is formed from a rare earth oxide.

9. The cell defined in claim 8 wherein the rare earth oxide is yttria.

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10. The cell defined in any one of the preceding claims wherein the lining is continuous and covers all of the surface of the body of the membrane that would otherwise be in contact with the electrolyte so that there are no sections of the body that are in contact with the electrolyte on the cathode side of the membrane.

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11. The cell defined in any one of the preceding claims wherein the cathode also includes an electrical conductor.

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12. A method of electrochemically reducing a metal oxide includes a step of operating the cell defined in any one of the preceding claims at a potential that is above a decomposition potential of at least one of the constituents of the electrolyte so that there are cations of a metal other than that of the metal oxide in the electrolyte.

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13. The method defined in claim 12 wherein, in a situation in which the metal oxide is a titanium oxide and the electrolyte is a  $\text{CaCl}_2$ -based electrolyte that includes  $\text{CaO}$  as one of the constituents, the cell potential is a potential above that the decomposition potential for  $\text{CaO}$ .

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14. An electrochemical cell for electrochemical reduction of a metal oxide in a solid state substantially

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as hereinbefore described with reference to the accompanying drawing.

15.           A method of electrochemically reducing a metal  
5 oxide substantially as hereinbefore described with  
reference to the accompanying drawing.